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ASSESSMENT OF SALINE WATER INTRUSION IN A COASTAL REGION OF KERALA, INDIA

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Abstract

The behavior of groundwater flow in coastal aquifers is influenced by variations in salinity and density levels. Models for groundwater flow and solute transport are employed to analyze the impact of these variations. In this study, a groundwater flow and solute transport model was developed for the coastal aquifer of the Bharathapuzha River. Visual MODFLOW 2.8.1 and MT3D were utilized for modeling groundwater flow and solute transport, respectively. Water level and quality data were collected from 18 observation wells in the field on a monthly basis from 2012 to 2021. Additionally, monthly water level data from four wells managed by the Central Water Commission (CWC) were incorporated as input for the models. Hydrogeological properties of the aquifer, such as specific yield, porosity, and specific storage, were obtained from the Groundwater Department and available literature. The model was calibrated and validated using field data and subsequently employed to predict groundwater flow and solute transport in the area. The results indicate that the river stretch is highly susceptible to saltwater intrusion. Salinity levels in certain wells (wells 7, 8, 13, and 14) exceeded the acceptable limits for drinking water as per the BIS standards. Based on model predictions, saltwater intrusion is projected to extend approximately 4.8 to 5 km from the Ponnani estuary, laterally upstream along the river course, within the next 10 to 15 years if pumping rates increase by 5 to 10% from the current rate. If the pumping rate rises by 15 percent, the intrusion may extend up to 6 km from the coast. Therefore, it is crucial to implement optimal freshwater withdrawal strategies and mitigation measures in these areas to safeguard the coastal aquifers. Restricting groundwater usage along the river banks within a lateral distance of at least 5 km from the seashore is recommended.

Keywords: Bharathapuzha, groundwater model, MT3D, Visual MODFLOW

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